

Research Paper



## Enhancing Clinical Coding Expertise in Indonesia's National Health Insurance Program

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**Abstract:** Coding medical records using classification systems can cause inconsistencies, sometimes leading to claim disputes. In January 2021, 440,749 disputed cases were reported, with a total disputed cost amounting to Rp873,111,325,287 for referral healthcare facility claims under the National Health Insurance (JKN). In May 2021, BPJS Kesehatan established the Clinical Coding Expert/Tim Ahli Pengodean Klinis (TAPK) for enhancing clinical coding expertise. The objective of this study was to examine the impact of establishing TAPK. We hypothesize that TAPK affects the decrease in disputed cases in 12 regions of Indonesia. We used data from the JKN Program prior to the establishment of TAPK in January 2021 as controls. We followed up on 86,272 cases for two years after its implementation (as of April 2023). Paired data from 12 regions were compared using descriptive statistics, inferential statistics (paired sample t-test), and boxplot visualization. We also described the knowledge management of clinical coding through Knowledge Spiral of Nonaka and Takeuchi. The finding showed a decrease in the number of claim dispute cases in April 2023 compared to January 2021 (by 80.43%). The average claim cases decreased from 36,729.08 (Before TAPK) to 7,189.33 (After TAPK;  $t = 2.620$ ,  $p = 0.0238$ ). TAPK has contributed to standardized coding practices in hospitals across regions. This study reinforces the importance of action to improve competence and organizational learning in TAPK through Knowledge Spiral Model and recommends that TAPK be more widely known to all JKN's healthcare facilities. Future research should optimize AI-driven clinical coding while ensuring human oversight.

**Keywords:** Clinical Coding; Coding Accuracy; Disputed Claims; Knowledge Management; Organizational Learning

## Introduction

The process of standardizing codes using classification systems such as ICD-10 system can lead to variation in practices including disputed claims due to factors like ambiguity in documentation, different interpretations, evolving standards, and human error. Before 2021, there were many reports about dispute claims of the National Health System (JKN) Program organized by BPJS Kesehatan in Indonesia, the majority of which is attributable to clinical coding dissent. Claims are returned by BPJS Kesehatan to hospitals if deemed inappropriate, which causes delayed payments (Irmawati, Marsum, and Monalisa, 2019) and affects both hospital cash flow and the quality of hospital services (Yastori, 2023). The study by Irmawati et al. (2019) showed that returned claims are due to coding with not one, but multiple, conditions listed as the primary diagnosis. To mitigate this, organizations use training, audits, and sometimes clinician involvement to improve consistency and accuracy. One of innovations from BPJS Kesehatan is the establishment of the Clinical Coding Experts Team (TAPK). The impact of TAPK in reducing the number of disputed claims and accelerating the N-1 claims process in the JKN program warrants a comprehensive study. This paper aims to describe the formation, role, capacity-building process, knowledge transfer, and impact of TAPK BPJS Kesehatan.

TAPK was established in 2021 - known as the Team of Coding Experts. In 2023, its name became the Team of Clinical Coding Experts (TAPK) through Decree No. 159 of 2023. There are six TAPK's tasks: *first* to hold a monthly meetings to recommend settlement of disputed claims, revise the verification application logic, and revise the claim verification process; *second* to perform continuous learning about clinical coding; *third* to provide sharing sessions about clinical coding; *fourth* to act as speakers on clinical coding in public meetings; *fifth* to evaluate and report on clinical coding at least once every six months; and *sixth* to assist in the preparation of regulations regarding clinical coding.

In articulating the competence of the employees involved to solve the difference in understanding of clinical coding, the goal is to achieve competency through training and experience. This training aligns with Sass et al. (2020), who put forward the importance of the concept of competence to act (Action Competence) as a link for other competencies in solving sustainability issues. Another challenge in the field of health services is to compensate for limitations, turnover, skill demands, and human resource training needs in response to changes in health needs and advances in technological developments within the health sector. Similar challenges also occur for coders in hospitals, necessitating continuous improvement for their competency and understanding of clinical coding (Schalkwyk et al., 2020).

One designated effort to improve clinical coding expertise was to include TAPK members by participating in international-level training facilitated by the American Health Information Management Association (AHIMA). AHIMA is a leading authority in health information management, guiding healthcare organizations in adapting to technological changes. As AI transforms clinical coding, AHIMA emphasizes that coders must shift from routine tasks to roles focused on auditing, validating AI outputs, and ensuring compliance,

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supported by strong governance and continuous skill development (Muthukumaraswamy, 2023).

### Knowledge Management

In the 1990s, Nonaka and Takeuchi's Knowledge Spiral Model was introduced as a foundational framework for knowledge management that explains how organizations create and share knowledge through four stages: Socialization, Externalization, Combination, and Internalization (SECI). It describes a dynamic process of converting tacit knowledge (personal, experience-based, hard to formalize) into explicit knowledge (formal, codified, easily communicated) and vice versa (Doan et al., 2021; Kahrens & Früauff, 2018; Żatuchin, 2024). To improve competence and organizational learning, especially about clinical coding, it is important to expand and utilize this SECI. This study described how this works in TAPK's knowledge management. The project's purpose was to help individuals better understand clinical coding, update medical records, and ensure that healthcare prices are more accurate throughout Indonesia. AHIMA's training & certification enables TAPK members to learn from the best practices of individuals worldwide, making it easier for them to execute their duties and for clinical coding to be more uniform across hospitals. This socialization stage is particularly crucial in fields such as healthcare, education, and clinical coding, as formal documentation cannot independently demonstrate an individual's skill level. It prepares things for the next step, externalization, which occurs when information that was previously unclear becomes clear and transparent.

Empirical studies confirm that metacognitive ability significantly enhances employee performance, particularly in virtual and collaborative work settings (Jain, Singh, & Bhalla, 2024; Bajaj et al., 2024). SECI remains profoundly relevant in the current era of digital and AI-driven organizational transformation because it continues to serve as the theoretical backbone for knowledge creation—even as knowledge flows become increasingly complex and technology-mediated. Recent studies decisively reinforce its enduring value: Cerchione et al. (2024) demonstrate how SECI underpins the newly proposed WISED model, which adapts SECI's mechanisms—webification, integration, systematization, explicitization, and digitalization—for modern, Industry 4.0 ecosystems. Meanwhile, Böhm and Durst (2025) validate SECI's core structure while integrating generative AI to form the GRAI framework, showing that SECI remains critical for structuring knowledge generation even when empowered by AI tools. Additionally, Żatuchin (2024) provides empirical evidence in education settings that embedding SECI in digital course design significantly improves tacit-to-explicit knowledge transfer. These findings collectively position SECI not only as current and applicable but also as a dynamic model capable of evolving with contemporary organizational and technological landscapes.

Socializing knowledge is an important stage of interconnected learning and teaching. Tacit knowledge is observed through application and experience before being absorbed and disseminated across departments and hierarchies by a shared responsibility of firstly gaining knowledge and then processing and sharing (or externalizing) more explicit

knowledge via modal-modal language, semiotics, images, and models (Doan et al., 2021). During the externalization phase, TAPK synthesizes what it has learned from experience and intuition into rules and procedures that everyone can follow. For example, a clinical coder who has been doing the job for many years can sort diagnoses without even thinking about it. This information is useful for constructing decision-making frameworks, coding guides, or training materials that others can utilize. This process of converting information helps businesses track critical data and use it within their systems and resources.

Nonaka and Takeuchi assert that verbal communication and cognitive processes are fundamental components of externalization. When people engage in meaningful discussions, they can share their life experiences and gradually transform their implicit insights into clear thoughts. People often try new things and refine them as they seek better ways to explain complex ideas. TAPK has made this information easy to find by creating a clinical coding guide. Externalization is highly important in fields such as healthcare, education, and technology, where specialist knowledge needs to ensure consistency and high quality. The TAPK project at BPJS Kesehatan demonstrates how to externalize code logic by writing down code, creating handbooks, and developing training modules. One of TAPK's innovations is the handbook, so-called Clinical Coding Tips (Figure 1), in electronic format. This e-book helps everyone in the organization leverage each person's expertise.

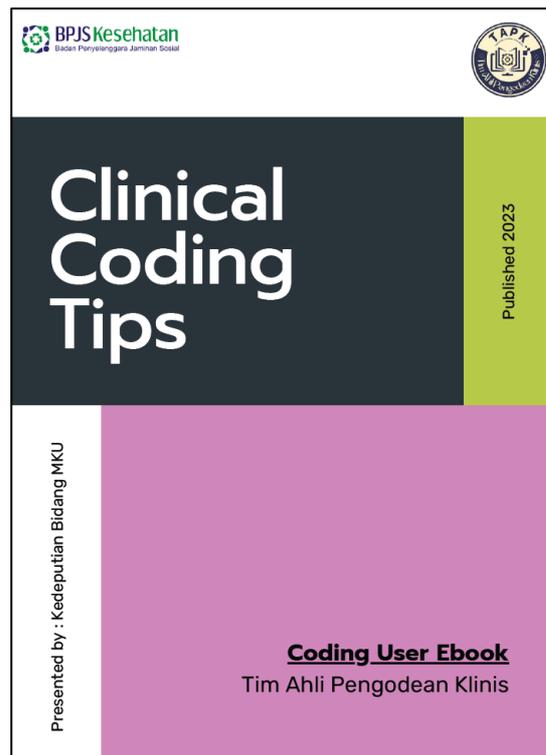


Figure 1. An Innovation from TAPK

This e-book provides guidelines for claim verification, grounded in coding principles based on ICD-10, ICD-9-CM, clinical guidelines, established recommendations, and specific

JKN regulations. It can be accessed by verifiers or coders via computer, tablet, or smartphone anytime, in a dynamic, practical, and user-friendly manner.

In the combination phase, TAPK takes separate pieces of clear knowledge and integrates these to build a more comprehensive and well-organized information system. Combination is important for organizational learning because it takes information that is not well-organized and puts it into formats that are easier to use, helping with decision-making, generating new ideas, and running a business more smoothly. This step involves compiling and organizing information from various sources, including official papers, databases, reports, and policy guidelines, into structured formats such as strategy frameworks, standard operating procedures, or manuals. This process typically requires a significant amount of information technology, as it enables everyone in the firm to save, find, and share data easily. TAPK employed clear information from ICD rules, recommendations, and policies to turn the logic of clinical coding into a business process. TAPK made it easier for the IT team to determine where to place the verification logic in the verification application.

The final stage of the SECI model benefits not only the individual, but also their team, department, and the entire organization through created, transformed and shared tacit knowledge, creating a continuous cycle of evidence-based continuous improvement (Doan, et al, 2023). Internalization is the process by which TAPK transforms explicit knowledge into tacit knowledge. For example, embedding these clinical coding practices into tacit competence through continuous use, TAPK conducts sharing sessions with verifier friends in the original work unit. Additionally, TAPK collaborates with various stakeholders, including hospitals and the Ministry of Health. Figure 2 shows an example of internalization stage.



Figure 2. Internalization Mode

People internalize formal information when they read manuals, guidelines, or training materials and then apply, practice, and implement what they have learned in real-

life situations. People can accomplish tasks well without needing to read written instructions because they become accustomed to these over time. For example, a coder learns about clinical coding standards and begins to follow these every day. The developer no longer needs the handbook because they already know what to do, and it influences their decisions without requiring them to think about it. This stage is crucial for maintaining the organization's learning momentum, as it ensures that people apply and retain what they have learned. Internalization is the final phase in knowledge production, enabling businesses to continue growing and generating new ideas.

## Method

### Research Design and Data Source

We employed a quantitative research design to evaluate the impact of the TAPK on the number of claim-dispute cases across 12 regional health offices (Kepwil) in Indonesia (Table 1). We collected data periodically from each region. Each region provided paired claim values representing performance *Before* and *After TAPK*. We use all the data as a population study. The analysis compares claim dispute cases data collected before and after the implementation of TAPK using descriptive statistics, inferential statistics (paired sample t-test), and boxplot visualization.

**Table 1. Number of claim dispute cases Before and After TAPK**

Region	Before TAPK	After TAPK
I	29,770	22,195
II	11,198	8,537
III	77,314	4,291
IV	140,988	13,452
V	14,827	18,131
VI	62,336	4,524
VII	12,368	2,540
VIII	11,035	397
IX	10,563	2,732
X	25,684	2,034
XI	44,559	7,038
XII	107	401

As shown in Table 1, *Before TAPK* refers to claim dispute cases in January 2021, and *After TAPK* refers to claim dispute cases in April 2023, or two years after its establishment in May 2021. There were 13 regional divisions of BPJS Kesehatan before the restructuring in 2023. The number of regions remaining is only 12 now. The dissolved region was region XIII, which previously consisted of seven branches. To enable a valid comparison between the periods before and after the establishment of TAPK, the number of disputes claims from the dissolved region (XIII) was proportionally redistributed based on the number of branches. Specifically, three out of seven branches were in the III region, and four out of seven branches were in the IV region. This proportional change maintains the structure of the regional data in both time periods.

### Data Analysis: T-Test

We conducted a paired sample t-test to determine if the changes between *Before* and *After TAPK* datasets were statistically significant. This method is suitable for analyzing two related datasets, such as measurements collected from the same places before and after the implementation of an intervention.

$H_0: \mu_{\text{Before TAPK}} = \mu_{\text{After TAPK}}$  (not significant)

$H_a: \mu_{\text{Before TAPK}} \neq \mu_{\text{After TAPK}}$  (significant)

We performed all analyses, including AVERAGE, MEDIAN, and STDEV, as well as the Box and Whisker Chart tool, using Excel.

### Conceptual Framework: The Knowledge Spiral Model

This study describes TAPK's application of Knowledge Spiral framework of the Nonaka and Takeuchi. This framework examines the SECI (Socialization, Externalization, Combination, and Internalization) Model (Figure 3).

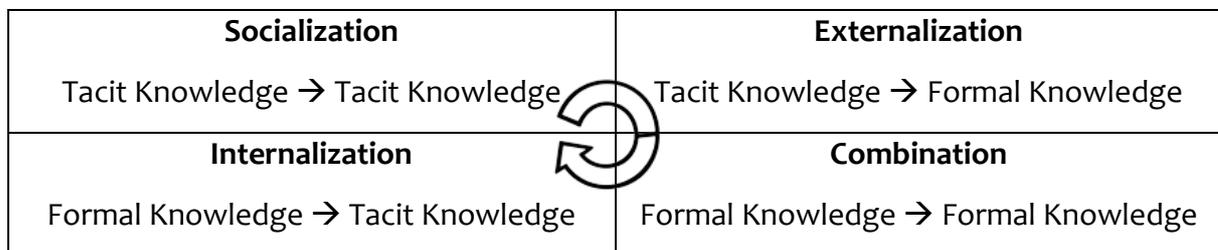


Figure 3. Knowledge spiral of Nonaka and Takeuchi (Avdeenko et al. 2016)

The SECI Model's Figure 3 illustrates how this type of knowledge transformation occurs, showing how four modes—socialization, externalization, combination, and internalization—can convert both tacit and explicit knowledge into organizational knowledge (Avdeenko et al. 2016). There are two kinds of information: tacit knowledge, which is what he/she knows in their head, and explicit knowledge, which is formal, structured, and clearly stated information, like what he/she learns in a training course. This is a flexible tool that illustrates how business processes generate knowledge and underscores the ongoing interplay between tacit and explicit knowledge, catalyzing innovation and organizational advancement. The personal insights that are hard to explain or write down come from context or experience and form tacit knowledge. This tacit knowledge encompasses instincts, experience, and talents through extensive learning. Explicit knowledge is easier to communicate about because it is written down and organized. Some examples are databases, manuals, and written instructions.

This Knowledge Spiral Model outlines four ways people can help the whole organization learn by sharing what they know one another. *Socialization* involves sharing private knowledge through activities such as mentoring, observing, or simply talking with other, thereby getting to know new people. People can acquire new knowledge and skills without needing to record them. The goal of *externalization* or putting things outside is to make tacit knowledge more accessible and easier to understand. People often use mental models, metaphors, or written records to help others understand complex concepts. Then, there is *combining* a multitude of simple facts into a more ordered and complex group of facts. This mode includes organizing, categorizing, and synthesizing knowledge from

various sources to create new frameworks or procedures. *Internalization* is when he/she takes in clear information and turn it into an implicit understanding by practicing and learning from their experiences. People can acquire formal ideas and apply them at work without even thinking about them by attending training sessions, participating in simulations, and engaging in hands-on exercises.

Socialization, externalization, combination, and internalization are the four mechanisms that work together to create knowledge. This dynamic spiral takes what one person learns and makes it valuable for everyone in the organization. The SECI Model is particularly beneficial in healthcare settings, where knowledge-intensive learning is ongoing, and procedures and shared information help the Clinical Coding Expert Team (TAPK) in achieving clinical coding knowledge. TAPK demonstrates the practical application of highly contextualized learning to enhance clinical coding competencies through peer-to-peer interactions (socialization), the formalization of coding guidelines (externalization), the integration of regulatory standards (combination), and structured training programs (internalization).

## Results

### Descriptive Statistics

We used descriptive statistics to examine and compare the distributions of cases in which people disagreed with a claim *Before* and *After TAPK* (Table 2). Some of the most important statistical indicators identified include the mean, median, standard deviation, minimum, and maximum values.

**Table 2. Descriptive statistics**

Condition	Mean	Median	SD	Min	Max
<i>Before TAPK</i>	36,729.08	20,255.50	40,244.21	107	140,988.29
<i>After TAPK</i>	7,189.33	4,407.50	7,146.09	397	22,195

The descriptive study, as shown in Table 2, revealed significant disparities in the volume of dispute claim cases before and after the implementation of TAPK. It presents the most relevant information, as it went down from 36,729.08 to 7,189.33. The standard deviation went down from 40,244.21 to 7,146.09. Following the implementation of TAPK, this decrease suggests that coding methodologies have become considerably more consistent and less susceptible to modification.

The significant drop in mean values suggests that TAPK has successfully minimized administrative errors, resolved coding disputes, and enhanced the competence of claim management under the JKN system.

$$t_{hitung} = 2.620$$

$$t_{tabel} = 2.201$$

$$t_{hitung} > t_{tabel}$$

The rejection of the null hypothesis indicates a substantial effect between the examined variables. The t-value was 2.620 (Table 3), and the p-value was less than 0.05. It means that the result is statistically significant. It indicates that using TAPK significantly reduces the number of claim disputes.

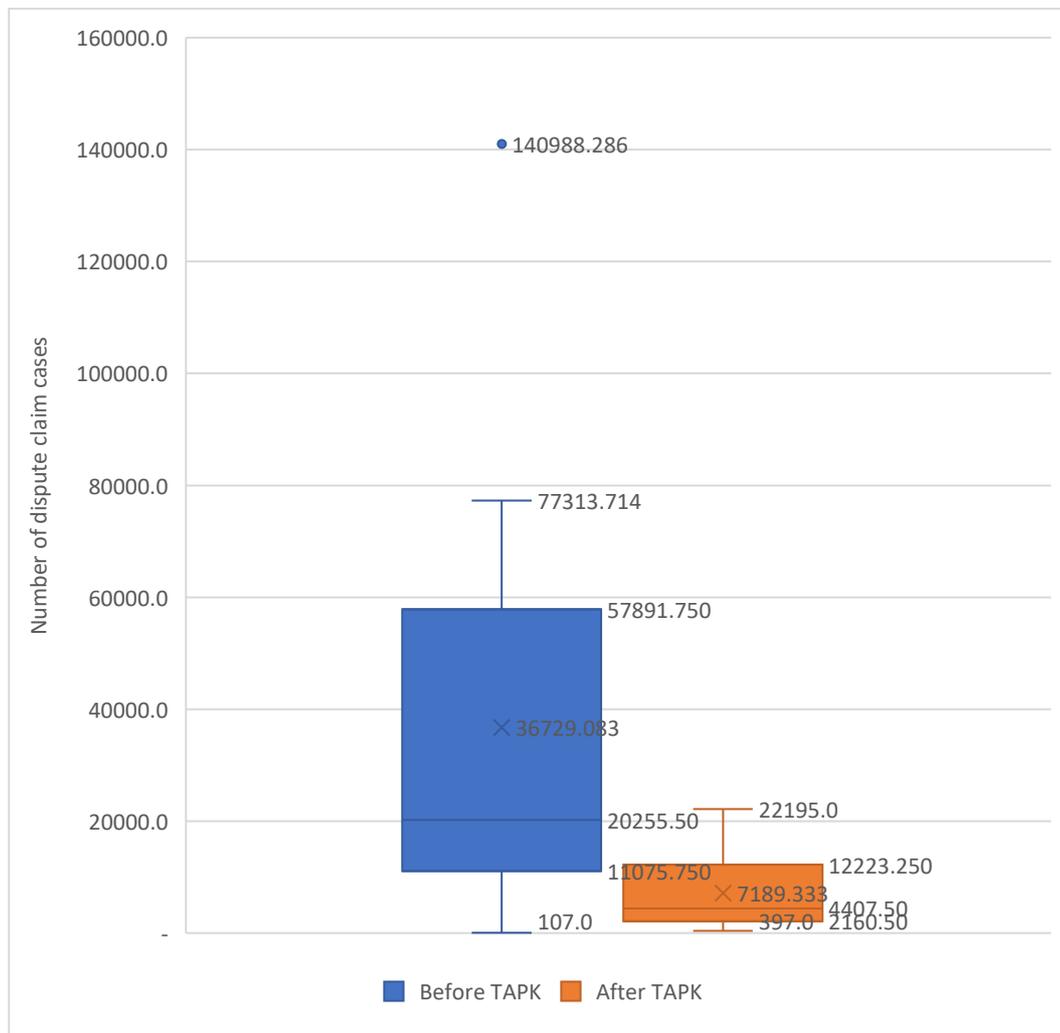
**Table 3. Paired T-test results**

Statistic	Value
t-statistic	2.620
p-value	0.0238

As shown in Table 3, the results indicated a significant difference,  $t(df) = 2.620$ ,  $p = 0.0238$ . Therefore, we reject the null hypothesis and conclude that there is a statistically significant difference between the two groups or conditions. Because  $2.620 > 2.201$ , the result is statistically significant at the specified confidence level, and we conclude that TAPK has a substantial effect on reducing the number of dispute cases.

### Boxplot Analysis

A box plot, as shown in Figure 4, illustrates how the coding values changed and spread out *Before* and *After* TAPK. This approach to graphing displays crucial statistical information, such as the median, the interquartile range, and any outliers.



**Figure 4. Boxplot of the number of dispute claim cases *Before* and *After* TAPK**

As shown in Figure 4, the boxplot for the *Before TAPK* data indicates greater diversity, with a larger range and more points that deviate from the rest of the data. The *After TAPK* data, on the other hand, show a more compact distribution, which implies that coding techniques are improving.

## Discussion

In global healthcare systems, for example, in the United States, clinical coding experts play a pivotal role in ensuring accurate morbidity coding and facilitating the transition from ICD-10-CM to ICD-11. According to research published in the *Journal of the American Medical Informatics Association*, a structured approach using ICD-11's stem codes, post-coordination, and semantic mapping. This approach enables approximately 89% of ICD-10-CM codes without requiring U.S.-specific modifications. It highlights the expertise needed to balance technical precision with practical implementation in electronic health records (EHR), ensuring data integrity for clinical, administrative, and research purposes (Fung et al., 2023).

In Germany, the role of clinical coding experts has expanded beyond manual coding to include the integration of advanced computational methods. A recent study in *Studies in Health Technology and Informatics* demonstrates that retrieval-augmented generation (RAG), combined with semantic embeddings and FAISS indexing, significantly improves coding accuracy for German clinical texts. This evolution underscores the necessity for coding professionals to possess interdisciplinary skills—bridging clinical knowledge with artificial intelligence—to optimize coding workflows and maintain compliance with international standards (Krumnscheid et al., 2025).

In the United Kingdom, clinical coding experts are essential for maintaining high-quality data in primary care settings, where SNOMED-CT is widely used. A qualitative study in the *British Journal of General Practice* reveals that both clinical and non-clinical staff face challenges in coding under time constraints, emphasizing the importance of expert oversight to ensure consistency and reliability. Furthermore, a review in *npj Digital Medicine* highlights that while automated coding systems are advancing, human expertise remains indispensable for auditing, quality assurance, and ethical governance of health data (Davies et al., 2025; Dong et al., 2022).

In Indonesia, because the process of converting and translating medical documentation into standardized codes can lead to variations in practices, including disputed claims, the existence of TAPK holds an important role in the JKN Program. The study's findings indicate that the TAPK program significantly reduced. The decreasing mean and standard deviation numbers suggest that clinical coding techniques are now more accurate, efficient, and consistent. These results align with TAPK's primary objectives of standardizing coding methods and reducing errors and disputes at work, as demonstrated by other studies (Sulaimana et al., 2019; Yastori, 2023).

The t-test was statistically significant and not due to chance. The boxplot backs this up by showing that *After TAPK* data has a more concentrated distribution and fewer outliers. The outliers mean that the areas are more stable. However, two areas, region V and region XII, stood out because they had more disputes after the TAPK modification. These outliers might be related to issues in the area (such as reporting, operational problems, or reorganization, as per Decree No. 494 of 2022). Future research should investigate these disparities using qualitative methodologies and consider developing tailored policy responses to ensure equitable outcomes.

The bar chart, which shows the average claim values *Before* and *After TAPK*, supports the evidence. The average in *Before TAPK* bar was 36,729, which is substantially greater than *After TAPK* bar (40,244.21). This higher average means that the quantity of claims was higher in some regions of the hospital and less stable in others. On the other hand, *After TAPK* bar has a mean of 7,189.33 and a standard deviation of 7,146.09, both of which are substantially lower. It means that not only has claim value decreased, but they have also become more stable since the implementation of TAPK.

This picture supports the idea that TAPK speeds up and standardizes the claims-filing process. The big decline in mean values shows that TAPK helped staff make fewer mistakes with paperwork and coding. At the same time, the reduced range of values suggests that hospitals in different areas used the same claim procedures more consistently once TAPK was in place. These advances further strengthen the case that TAPK enhances claim management skills and helps hospitals achieve financial stability under the JKN system.

These results align with the concept of action competency proposed by [Sass et al. \(2020\)](#), which emphasizes the importance of combining skills, knowledge, and motivation for effective practice. TAPK helps personnel become more aware of their roles and more skilled at their work, enabling them to handle claim paperwork more accurately.

TAPK provides coders and verifiers with the tools they need to complete complex tasks, reducing doctors' coding workload. This coding work is what shifting entails ([Schalkwyk et al., 2020](#)). This shift in responsibilities allows doctors to spend more time with their patients. International research supports this concept, showing that systematic training improves ICD-coded data ([Varela et al., 2022](#)).

The establishment of TAPK has successfully maintained the knowledge expansion of clinical coding. Hospitals not only improve individual competence but also transform these gains into organizational knowledge, sustaining long-term improvements in claim management. This ensures that improvements in coding accuracy are not only temporary outcomes but also part of a sustainable system of collective knowledge and expertise.

Clinical coding knowledge obtained by TAPK from trainings, especially direct trainings from trusted renowned international sources experts in the world or international benchmarks, needs to be disseminated more widely to stakeholders, for example, collaboration with the Ministry of Health to discuss disputed claims that must be agreed

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upon by BPJS Kesehatan and the Ministry of Health according to Ministerial Regulations Health Number 26 of 2021.

In addition, TAPK members have undertaken various collaborations, particularly with hospitals within the originating work unit. This collaboration further equalizes the understanding of clinical coding. Shared knowledge of clinical coding will reduce disputes and claim cases and expedite the claims process, ultimately resulting in fewer disagreements and a faster JKN claims process.

## Conclusion

TAPK significantly reduced the number of contested claims, including medical-dispute claims, coding, and benefits coordination, enhanced claim-management skills, and provided the basis for a standard national training program for policymakers. Future research should use multicenter longitudinal studies to evaluate the long-term effects of TAPK across various hospital types and geographic regions, supplemented by mixed methods approaches that incorporate comprehensive interviews with coders, verifiers, and hospital administrators. This would yield more comprehensive insights into the contextual challenges, behavioral changes, and organizational learning mechanisms associated with the adoption of TAPK.

In the long term, BPJS K could consider adopting additional global best practices to support ongoing learning and professional development. These could include practices common in OECD nations in Europe and North America, such as establishing a professional association, administering standardized national tests for certification every 2–3 years, and fully accrediting coding skills through additional training. BPJS Kesehatan has taken the necessary initial steps, and these measures are already having a positive impact on Indonesians.

TAPK has undergone all modes of knowledge conversion. Each TAPK member in the original work unit continues to engage in internalization and collaborates with stakeholders, particularly the Ministry of Health, to discuss and resolve disputed claims. Future research should also investigate the optimization of AI-driven clinical coding systems for accuracy and compliance while preserving human oversight.

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